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*Indian Standard*

GENERAL REQUIREMENTS AND  
TESTING OF MARINE INFLATABLE LIFERAFTS

UDC 629.125.53 : 629.125.144 : 620.1



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MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG  
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# Indian Standard

## GENERAL REQUIREMENTS AND TESTING OF MARINE INFLATABLE LIFERAFTS

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# *Indian Standard*

## GENERAL REQUIREMENTS AND TESTING OF MARINE INFLATABLE LIFERAFTS

### 0. FOREWORD

**0.1** This Indian Standard was adopted by the Indian Standards Institution on 30 April 1986, after the draft finalized by the Marine Instruments and Safety Aids Sectional Committee had been approved by the Marine, Cargo Movement and Packaging Division Council.

**0.2** In the preparation of this standard, current work of ISO/TC 8 'Ship-building and marine structures' and the provisions under SOLAS\* convention of the International Maritime Organization (IMO) has been taken into account.

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### 1. SCOPE

**1.1** This standard gives the general requirements, equipments to be carried and tests for marine inflatable liferafts.

### 2. TERMINOLOGY

**2.0** For the purpose of this standard the following definitions shall apply.

**2.1 Lifelines** — These are grab lines becketed all around and on the inside of liferafts in such a manner as to provide a number of loops.

**2.2 Quoit** — A buoyant ring attached to the end of a rope used for rescue work.

**2.3 Painter** — A minimum length of 24 metres of rope one end of which is suitably attached on the liferaft for the purposes of towing.

**2.4 Sea Anchor (Drogue)** — A nylon cloth of suitable area with a small reinforced central hole and the corners being connected together by a suitable length of nylon rope to form a pyramid when in use and act as a drag to the liferaft in bad weather or choppy seas.

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\*Safety of life at sea.

### 3. CONSTRUCTION

**3.1** The inflatable liferafts shall consist of a main unit, comprising main buoyance chamber, main floor, canopy support, canopy and thwart as required, accessories to the main unit, emergency equipment and container or valise. The liferaft shall be of sufficiently robust construction to remain afloat when fully laden for at least 30 days. There shall be no deterioration involving loss of seaworthiness when the raft is subjected to the 30 days exposure. The liferaft shall be so constructed that when inflated and floating with the cover uppermost it will be stable in a seaway.

**3.2** All material and components used in the construction of a liferaft, its accessories and container shall be able to withstand world-wide seagoing climatic conditions. A liferaft and its accessories when stowed in the liferaft container shall be resistant to the effect of humidity and all materials, for example, fabrics, cordage; webbing and thread shall be inherently rot-proof or rot-proofed by an acceptable method. The liferaft assembly shall be able to withstand weather deck stowage on board ship with a minimum of protection to the operational valise or container.

**3.2.1 Buoyancy Chamber** — The buoyancy chambers of the liferaft shall be so arranged as to ensure by a division into an even number of separate compartments, half of which shall be capable of supporting out of the water the number of persons which the liferaft is permitted to accommodate, that there is a reasonable margin of buoyancy if the raft is damaged or partially fails to inflate.

**3.2.2 Main Floor** — The floor of the liferaft shall be water-tight, and shall be capable of providing thermal insulation from the water in which it is floating. Where this is achieved by means of inflation, provision shall be made for deflating the compartment. The floor shall be sufficient area for the number of persons which the liferaft is classified to carry.

**3.2.3 Canopy Support** — The canopy support shall be erected automatically to extend the canopy when the liferaft is inflated. The canopy shall remain erect if any of the main chambers are deflated.

**3.2.4 Thwart** — The inflatable liferaft may be fitted with a thwart which is inflatable. In the case of the single buoyancy tube liferaft, the thwart shall be inflated by gas automatically, and if any of the compartments of the buoyancy tube is deflated, the intact compartment(s) together with the thwart shall form the boundary of and maintain the stability of the liferaft.



**3.2.5 Canopy** — The canopy shall erect automatically on inflation of the liferaft and shall have at least the following requirements provided:

- a) It shall be of double construction consisting of an outer cover and an inner cover with an adequate air space in between for providing thermal insulation. Entrance shall be similarly insulated.
- b) At least two entrances shall be provided, each on an opposite side of the raft, with effective means for closing, except that on rafts classified for eight or less persons one such entrance may be accepted, provided that adequate ventilation is available.
- c) The height of the canopy shall be such that the occupants can sit comfortably upright on the floor.
- d) Means of collecting rainwater shall be provided in the outer cover. It shall be possible to collect this water inside the raft when the entrance is closed. For such purposes, the outer cover material shall not contain substances known to impart injurious qualities to the drinking water collected from the cover.
- e) The canopy shall have a marker lamp provided at the top and a room lamp in the interior, each receiving current from its own water activated cell, or from other suitable source of supply. The marker lamp and room lamp shall be served by separate circuits and suitable means shall be provided to save discharging in day time. The luminous intensity of each lamp shall be at least 0.3 candela. The water activated cells shall have the capacity to light the marker lamp and room lamp for at least 12 hours.

**3.2.6 Liferafts for Use with Launching Appliance** — The devit-launched liferaft shall have a device adapted for connection to a launching appliances and means of holding a suspended raft to the side of the ship at the boarding station so that the liferaft with full complement and emergency equipment can be launched safely.

## 4. GENERAL REQUIREMENTS

**4.1 Types** — The inflatable liferafts shall be of the following types:

- a) Types for use by jettisoning;
- b) Types for use with launching appliance.

**4.2 Temperature Range** — The inflatable liferaft shall be capable of operating throughout the temperature range 66 to  $-30^{\circ}\text{C}$ .

### 4.3 Working Gas

**4.3.1 Kind of Gas** — The working gas used for inflation of inflatable liferafts shall be a high pressure liquefied carbon dioxide gas, or a mixture of a high pressure liquefied carbon dioxide gas and a high pressure nitrogen gas or any other suitable gas or mixture of gases which are similarly non-toxic and non-inflammable.

**4.3.2 Purity of Gas** — The gas shall be of a purity of at least the following values:

	<i>Moisture Content in Percent by Weight, Max</i>	<i>Purity in Percent by Weight, Min</i>
Liquefied carbon dioxide gas	0.015	99.5
Nitrogen	—	99.5

**4.3.3 Amount of Gas** — The amount of gas provided shall be such that in the case of jettisoning types, the raft shall inflate to the extent that the inflatable chambers shall assume their full shape and the canopy shall be sufficiently erect to allow occupants to get under the cover within the time of 3 minutes at ambient temperature of  $-30^{\circ}\text{C}$ ; and in the case of devit-launched types, the raft shall attain the full working pressure within the same time at the same temperature.

**4.3.4 Filling Ratio** — The gases shall be filled in a ratio as specified in IS : 8198 ( Part 3 )-1976\*.

### 4.4 Carrying Capacity

**4.4.1 Types by Capacity** — Inflatable liferafts are classified according to the carrying capacity. Following 6 types are recommended: for 6, 12, 15, 16, 20 and 25 persons.

**4.4.2 Calculation of the Capacity** — The capacity shall be the smaller of the numbers calculated as follows:

- Maximum integer obtained by dividing by 96 the volume ( in cubic decimetres ) of the main buoyancy chamber in the inflated condition, which for this purpose shall include neither the canopy supports nor the thwarts;
- Maximum integer obtained by dividing by 3 720 the area ( in square centimetres ) of the floor in the inflated condition, when measured to the inside periphery of the buoyancy chambers, which for this purpose may include the thwarts but shall not include the area occupied by the canopy supports.

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\*Code of practice for steel cylinders for compressed gases: Part 3 High pressure liquefiable gases.

In both cases, the raft shall be inflated to the designed working pressure.

Where the capacities and areas are obtained by direct calculation from material sizes these capacities and areas shall be confirmed on an inflated raft.

**4.5 Mass** — The total mass of the inflatable liferaft with its emergency equipment and container or valise shall not exceed 180 kg.

## 5. ACCESSORIES TO THE MAIN UNIT

**5.0** The accessories to the main unit of inflatable liferafts shall be compatible with the main unit with respect to the material and construction and shall comply with the requirements of **5.1** through **5.7**.

**5.1 Cylinder** — The cylinder shall be as per IS : 8198 ( Part 3 )-1976\*.

### 5.2 Sealing Discs

**5.2.1 Safety Disc ( Bursting Disc )** — The cylinder shall have a corrosion resistant safety disc or other device incorporated to prevent bursting of the cylinder

**5.2.2 Sealing Plate ( Destructive Valve )** — A sealing plate ( destructive valve ) shall be used to retain the gas in the cylinder until the time of release of gas into the liferaft. A valve ( check valve ) may be used as an alternative to the sealing plate.

**5.3 Inflation Apparatus** — Release of the gas in the cylinder into the inflatable liferaft shall be carried out by the operation of an inflation apparatus:

- a) The apparatus shall be designed to release the gas out of the cylinder into the raft by pulling an operating cable ( or painter ) strongly to pierce the sealing plate ( destructive valve ) or to open the valve ( check valve ). After operation of the cylinder, it shall be ensured that the painter load is transferred to the towing point of the raft.
- b) The check valve of the inflation apparatus shall be operated and opened fully when the operating cable is filled with a force not exceeding 150 N and with a travel of not more than 200 mm.
- c) Positive means shall be provided to see if the inflation apparatus is really operated when it has been set to operate and also to retain the valve in the open position when it has been operated.
- d) The operating cable assembly shall be made of corrosion resistant materials and shall be tested with a load of at least 450 N. The operating cable assembly shall be protected in a suitable flexible conduit, if necessary, to prevent chafing of the fabric and to ensure that the cable does not become kinked.

**5.4 High Pressure Hose Assembly** — A high pressure hose assembly provided to convey the gas from the cylinder to inflatable chambers shall comply with the following requirements:

- a) Every assembly shall pass a hydraulic test of 12·5 MPa for at least one minute, without any leakage.
- b) It shall operate satisfactorily over a temperature range of  $-30$  to  $+66^{\circ}\text{C}$ .
- c) As a type test, it shall be capable of being bent through 180 degrees over a former having a radius of 5 cm at  $-30^{\circ}\text{C}$ . Thereafter, it shall pass the hydraulic test of 12·5 MPa.
- d) Metal parts shall be corrosion resistant and free from sharp edges.
- e) The hose assembly shall be of a type which has a minimum bursting pressure of 21 MPa at normal temperature and 4·2 MPa at  $-30^{\circ}\text{C}$ .

## **5.5 Valve**

**5.5.1 Non-Return Valve** — Non-return valves shall be provided at each point where gas enters an inflatable chamber either from the cylinder or from another inflated chamber.

### **5.5.2 Topping-Up Valve and Deflation Plug**

- a) Each chamber, including canopy supports and thwarts shall be provided with a topping-up non-return valve of a self-sealing type which will allow air to be pumped into the chamber by a bellows or topping-up pump.
- b) Deflation plugs shall be provided for discharging gas out of each chamber or alternatively the topping-up valve may combine the function of a deflation plug.

### **5.5.3 Relief Valve**

- a) A relief valve shall be fitted to any chamber which is inflated directly from the gas cylinder to prevent the pressure in the chamber exceeding twice the designed working pressure and to reseal when the pressure is reduced to the designed working pressure.
- b) The relief valve may combine the function of a deflation plug and/or topping-up valve.
- c) Arrangements shall be made so that the excess gas is vented to the atmosphere and not into the raft.

**5.6 Cordage and Webbing** — The materials shall be inherently rot-proof not to be affected by oil or oil products and when made up into a fitting or part they shall be attached to the raft in such a manner that if accidentally detached, the raft structure will not be damaged. Specific items shall conform to the details given in Table 1.

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**TABLE 1 QUALITY OF CORDAGE AND WEBBING**

ITEM	MATERIAL	QUALITY
Painter of operating line	Inherently rot-proof fibre of suitable resistance to atmospheric degradation and lengths of exposed painter shall also have suitable resistance to sunlight degradation	<ol style="list-style-type: none"> <li>1) The painter length shall be sufficient at the least draught condition to allow for the stowage position of the liferaft taking into account list, trim and wave actions</li> <li>2) The breaking load of the painter system including the attachment to the liferaft shall not be less than 10·0 kN for liferafts carrying 9 persons or more and not less than 7·5 kN for liferafts carrying less than 9 persons</li> </ol>
External and internal lifeline	Inherently rot-proof fibre of suitable resistance to atmospheric degradation	<ol style="list-style-type: none"> <li>1) Shall be suitable to grab and not hurt the hand nor slip. If cordage it shall be not less than 8 mm dia, if webbing shall be not less than 25 mm wide</li> <li>2) Breaking load of the lifelines shall not be less than 2 kN and that of fastening points not less than 1 kN</li> <li>3) Each loop of external lifeline shall reach within 75 mm of water when raft is in loaded condition</li> </ol>

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**5.7 Other Accessories** — The inflatable liferaft shall be provided at least with the accessories and the equipments incorporated directly into the raft as given in Table 2. Any cordage, webbing or thread shall be rot-proof.

TABLE 2 QUALITY OF ACCESSORIES

( Clause 5.7 )

ITEM	QUANTITY	REMARKS
Boarding arrangement	1 at each entrance	Every liferaft shall be fitted at each opening with a semi-rigid boarding ramp or equivalent means to enable exhausted persons to enter the liferaft from the sea. The inflation of the ramp should be so arranged to prevent deflation of the liferaft in the event of damage to the ramp
Sea anchors ( with lines )	2	One permanently attached by a line not less than 9 m in length and fitted with a swivel at each end. The line shall be attached to the liferaft so that when the sea anchor is first deployed the liferaft will float with its openings at 90° to the direction of the wind, but by adjusting the bridle the survivors may turn the liferaft so that its openings are in line with the wind. The construction and performance of the sea anchor shall be tested as per statutory regulations
Water pockets		Sufficient in number and size to meet the stability requirements of the raft to the satisfaction of the administration
Righting arrangement	1	See 9.1.14
Rain water collector	1	See 3.2.5(d)
Marker lamp	1	See 3.2.5(e)
Room lamp	1	See 3.2.5(e)
Water activated cells		Shall be proof against leakage of chemicals which might damage or cause deterioration of the liferaft fabric. Shall be able to function satisfactorily in water of varying salinity and temperatures varying from freezing point to topical heat
		Shall be proof against moisture whilst the raft is stowed in its container
Retro-reflective tapes		Retro-reflective tapes of approximately 50 mm by 300 mm shall be fitted around the canopy at intervals or approximately 500 mm at the half height of the canopy measured from the point of attachment of the canopy to the buoyancy tubes. A cross shaped or similar marking of two such tapes shall be fitted on or at the top. On the underside of the floor four retro-reflective tapes of approximately 50 mm by 300 mm shall at equal intervals be fitted around the edges of the floor or of the bottom of the liferaft

( Continued )

TABLE 2 QUALITY OF ACCESSORIES — *Contd*

ITEM	QUANTITY	REMARKS
Rescue quoit ( with line )	1	<p>A buoyant rescue quoit shall be provided in the interior of the liferaft near the boarding entrance for throwing overboard to aid men in a wreck</p> <p>A buoyant rescue line of at least 30 m in length and of breaking strength not less than 1 kN shall be fitted to the rescue quoit, and the other end of the line shall be secured at the liferaft</p> <p>The line shall be properly coiled or flaked so that the quoit may be quickly thrown to the maximum distance</p>
Safety knife	2 for rafts carrying 13 persons or more and 1 for rafts carrying less than 13 persons	<p>Safety knife ( knives ) shall be provided at a readily accessible place in the inflatable liferaft</p> <p>The knife shall be secured to the liferaft by a lanyard and shall be stowed in the vicinity of the painter attachment</p> <p>The safety knife is for the use cutting the painter for sheering the liferaft off the side of the vessel, and it shall therefore be stored in a manner so that it will not damage the liferaft in the course of dropping</p> <p>It shall be of buoyancy so that it can float even when it is dropped inadvertently into the sea</p> <p>Another knife may be stored in the equipment bag or container</p>
Aerial attachment	1	<p>Shall permit easy erection of the aerial of the portable radio equipment and be so positioned that the entrances are not obstructed</p>

## 6. CONTAINER OR VALISE

**6.1** Each liferaft together with its necessary equipment shall be properly packed in a valise or container so designed as to provide maximum protection from the weather and so constructed as to be capable of withstanding hard wear and affording protection to the liferaft and its equipment under all seagoing conditions.

**6.2** The inside of the valise or container shall be smooth so as not to cause any damage to the fabric of the liferaft by chafing.

**6.3** The valise or container shall be so constructed that the liferaft will break free on inflation. It shall be a neat fit for the packed liferaft to prevent chafing of the liferaft fabric.

**6.4** The aperture in the container through which the painter runs shall be so arranged that the container will free itself from the painter on inflation without damage to the painter.

**6.5** Suitable means shall be provided for carrying the liferaft in its valise or container prior to launching. Effective means for drainage shall be fitted in the lower parts of rigid containers.

**6.6** The manufacturers of inflatable liferafts shall state any recommendations relating to its installation when packed ready for operation.

## **7. COLOUR**

**7.1** Components of inflatable liferaft shall be coloured as given in Table 3.

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**TABLE 3 COLOUR OF COMPONENTS OF INFLATABLE LIFERAFT**

ITEM	COLOUR
Main buoyancy chamber	Dark colour
Floor chamber	Dark colour
Exterior canopy	Flame orange or other highly conspicuous colours
Inside of the liferaft	The interior surface colour shall be chosen so as not to produce eye glare or discomfort to the raft occupants

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## **8. EQUIPMENT**

**8.1** The normal equipment for every liferaft shall consist of :

- a) Two sponges;
- b) Two paddles;
- c) One repair outfit capable of repairing punctures in the inflatable chambers;
- d) Three tin openers of special safety type;
- e) One approved first-aid outfit in a waterproof container;
- f) One rust-proof graduated drinking vessel ( see IS : 5314-1969\* );

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\*Specification for graduated drinking vessels for lifeboats and liferaft sea-going ships.



- g) One waterproof electric torch suitable for signalling in the more code together with one spare set of batteries and one spare bulb in a waterproof containers;
- h) One day light signalling mirror and one signalling whistle;
- j) Two parachutists distress rocket signals of an approved type, capable of giving a bright red light at a high altitude ( *see* IS : 3580-1966\* );
- k) Six hand flares of an approved type, capable of giving a bright red light ( *see* IS : 3580-1966\* );
- m) One set of fishing tackle;
- n) 340 grammes of suitable non-thirst provoking food providing at least 2 200 calories per 450 grammes weight and 170 grammes of barley sugar or other equally suitable sweets for each person the liferaft is deemed for to accommodate;
- p) Watertight preceptacles containing one and a half litres of fresh water for each person the liferaft is permitted to accommodate, of which half a litre per person may be replaced, by a suitable desalting apparatus capable of producing an equal amount of fresh water;
- q) Six anti-sea sickness tablets for each person the liferaft is certified to accommodate;
- r) Instructions printed in English and Hindi on how to survive in the liferaft; and
- s) One copy of the illustrated table of rescue and distress signals.

**8.1.1** This equipment shall be stowed in readily accessible containers easily opened and closed by a survivor with cold hands. These containers shall be secured inside the raft, shall provide protection against damage and penetration of water and shall remain buoyant for 30 minutes in water.

A list of contents shall be clearly shown on the outside of the container.

## 9. TESTING

**9.1 Type Tests** — When a new type of inflatable liferaft is produced, it shall be subjected to the following type approval tests to ensure that it conforms to the requirement of the respective test items. The test shall be done under conditions of normal temperature and normal atmospheric pressure, unless otherwise specified.

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\*General requirements for distress signals for lifeboats and liferafts.

**9.1.1 Visual Inspection** — Inflating the liferaft to the designed working pressure, check the conformance to design of the shape, construction, dimensions and markings.

**9.1.2 Mass Checking** — Mass checking shall be carried out of a complete set of liferaft with emergency equipment, packed in a container or valise. The total mass shall not exceed 180 kg.

**9.1.3 High Pressure Test** — The main buoyancy chamber and canopy support shall be inflated with relief valves plugged to an air pressure of twice the designed working pressure. They shall be allowed to stand for 10 minutes. There shall be no rupture, peeling, deformation or other damage.

**9.1.4 Air Tightness Test**

- a) The main buoyancy chamber, canopy support, and floor chamber if it is inflatable for the insulation, shall be inflated to an air pressure of the designed working pressure. They shall be allowed to stand for at least half an hour. Then the internal pressure of the respective chambers and compartments shall be adjusted to the working pressure. At the end of 1 hour after corrections for the temperature, a value not less than 90 percent of the original pressure shall be maintained for the main buoyancy chamber and canopy support at their compartments and at the end of half an hour a value not less than 80 percent of the original pressure for the floor chamber.
- b) Where there is a variation of temperature exceeding 3°C in the test chamber, the test result shall not be acceptable. The acceptable correction for temperature variation is calculated by 0.4 kPa for 1°C.
- c) With the canopy support and its associated buoyancy tube inflated to working pressure the buoyancy shall be deflated. At the end of half an hour the canopy support shall still be sufficiently rigid to support the canopy.
- d) Where an inflatable boarding ramp is fitted on deflation of the ramp, the buoyancy to which it is attached shall remain sufficiently inflated.

**9.1.5 Relief Valve Function Test** — The main buoyancy chamber and canopy support shall be inflated with an air pressure, and the internal pressures at which relief valves operate to relieve and to reseal of itself shall be measured. They shall be within the design limits.

**9.1.6 Inflation Tests**

**9.1.6.1 Normal temperature inflation test** — The liferaft packed in a container or valise shall be inflated by operating the attached gas inflation

device in an ambient temperature of  $27 \pm 2^{\circ}\text{C}$ , and the time required for inflation shall be measured:

- a) The main buoyancy chamber shall be inflated within 30 seconds to its full shape and diameter to permit embarkation on the liferaft.
- b) The canopy shall be erected within 90 seconds.
- c) The liferaft shall reach its full designed internal pressure within 3 minutes.

The inflation associated with the drop test may be accepted in place of this test.

**9.1.6.2 High temperature inflation test** — For the inflation at  $66^{\circ}\text{C}$  the operationally packed raft in a container or valise which need not be sealed shall be placed in a heating chamber for not less than 7 hours. The first 2 hours may be utilized for heating the chamber to  $66^{\circ}\text{C}$ . After a period of 5 hours at the full temperature the raft shall be inflated by pulling the painter. Under these conditions the gas pressure relief valves shall be of sufficient capacity to prevent damage to the raft by over pressure. Although it is preferred that the raft be heated in a chamber large enough to permit it being inflated therein, removal from the hot chamber prior to inflation is permitted provided the removal and inflation are carried out promptly.

**9.1.6.3 Low temperature inflation test** — The liferaft contained in a container or valise shall be allowed to stand for 24 hours in a room cooled to a temperature of  $-30^{\circ}\text{C}$ . Then, at the room temperature at  $-30^{\circ}\text{C}$ , it shall be inflated by operating the attached gas inflation gear, and the time required for inflation shall be measured. Within 3 minutes, the main buoyancy chamber shall be inflated to an extent sufficiently for the occupants to get under cover.

Davit-launched liferaft shall reach its full working pressure.

The low temperature inflation test shall stipulate that as a result of the test there shall be no slippage, cracking or other defect in the liferaft and that it shall be ready for use in all respects. Two consecutive successful tests shall also be required.

Where liferaft is not tested at  $-30^{\circ}\text{C}$ , such a liferaft shall be marked on the valise stating minimum temperature to which it has been tested.

**9.1.7 Drop Test** — Each type of complete liferaft in its container or valise shall be subjected to at least two drop tests from a height of 18 metres into the water. At least one drop test is to be carried out with the liferaft packed with each proposed type of emergency pack in any combination of pack or valise or container. If the raft is to be stowed on the ship at a height above the water of more than 18 metres it shall

be dropped from a height at least equal to the height at which it is to be stowed. The free end of the painter shall be attached to the point of suspension so that it pays out as the raft drops, thus simulating actual conditions. It shall be left floating for 30 minutes and at the end of this period be inflated by pulling the painter. The raft shall inflate upright within the accepted time ( see 9.1.6.1 ).

It shall then be lifted from the water to permit thorough inspection of the raft, the container or valise and the contents of the emergency pack. In the inflatable liferafts of the type where they start inflating as the operating cable gets automatically pulled in the process of drop, one of the two tests required shall be carried out in accordance with the description above, while in the other test, the start of inflation in the process of drop shall be tested.

In both cases, there shall be no damage or failure which will affect the functioning of the main unit or emergency equipment.

In any case, the main unit shall be confirmed by an airtightness test as specified in 9.1.4.

**9.1.8 Seating Test** — It shall be ascertained that the number of persons for which the liferafts is designed can be comfortably seated when each is wearing an approved lifejacket suitable for an adult and that there is sufficient space for them to carry out necessary tasks.

**9.1.9 Freeboard Test** — Upon the inflation of the liferaft into an operative condition, the freeboards under no load conditions and loaded conditions on water shall be measured. These values shall be not less than the designed values and in the fully loaded condition shall be not less than 300 mm.

**9.1.10 Stability Test** — The full complement of the raft shall be crowded to one side and then to one end and in each case the freeboard shall be recorded. Under these conditions the freeboard shall be such that there is no danger of the liferaft being swamped.

The stability of the liferaft during boarding may be ascertained as follows:

Two men each wearing approved life-jacket suitable for an adult should board the empty raft. It should then be demonstrated that the two persons in the raft can readily assist from the water a third person who is required to feign unconsciousness. The third person must have his back towards the entrance so that he cannot help himself into the raft. The Inspecting Authority is to be satisfied that the water pockets adequately counteract the upsetting moment on the raft.

**9.1.11 Damage Test** — When the liferaft is fully loaded with the number of persons it can accommodate, with either half of its buoyancy fully deflated it shall be confirmed that the liferaft is capable of carrying effectively the full rated load under this condition.

**9.1.12 Swamp Test** — The liferaft shall be inflated into an operative condition, floated on the water, loaded with the full rated load and then be swamped up to the upper surface of the main buoyancy chambers. Under this condition, it shall be demonstrated that the liferaft is capable of carrying the full rated load with no serious distortion nor damage.

**9.1.13 Boarding Test** — The boarding test shall be carried out in a swimming pool by a team of not more than four persons acceptable to the inspecting authority who should be of mature age and of differing physiques. Preferably they shall not be strong swimmers. For this test, they shall be clothed in shirt and trousers or a boiler suit and shall wear approved life-jackets suitable for an adult. They shall each swim about 90 m before reaching the raft to attempt the boarding, dressed as above and wearing the approved life-jackets. There shall be no rest period between the swim and the boarding attempt. Boarding shall be attempted by each man individually, that is, with no assistance from other swimmers or persons already in the raft. The raft shall be in water too deep to permit the men obtaining any assistance from the bottom of the swimming pool. The arrangements shall be considered satisfactory if three of the men board unaided and the fourth boards with the assistance of any one of the others.

**9.1.14 Righting Test** — For this test the raft shall be inverted. The righting test shall be carried out by the same team of 'survivors' similarly clothed and wearing approved life-jackets and after preconditioning as in boarding test. Each man shall attempt to right the raft unaided. The raft shall be in water too deep to permit the man's obtaining any assistance from the bottom of the pool when mounting the inverted raft. The righting arrangements will be considered satisfactory if each man rights the raft unaided.

**9.1.15 Davit-launched Liferaft Board Test** — In addition to the test in 9.1.13, it shall be demonstrated that the davit-launched liferaft inflated and suitably suspended and pulled toward a simulated ship deck at a 10° trim and a 15° adverse list, shall be boarded by a number of persons at least equal to its full complement wearing approved life-jackets unaided and without undue distortion to the liferaft. The boarding shall be timed and such time recorded.

#### **9.1.16 Lowering Test**

- a) The loaded liferaft which had been boarded as in 9.1.15 shall be released from the simulated ship's side left hanging for 5 minutes and then lowered to the floor or water. It shall show no signs of undue distortion or strain.

- b) A liferaft fully loaded by people or an equivalent weight shall be lowered a total distance of 18 m against a structure erected to represent the side of a ship; having a 15° adverse list.

**9.1.17 Overload Test** — The devit-launched liferaft shall be inflated and loaded in its actual manner with a weight equivalent to 4.5 times the total mass of the liferaft, its emergency equipment and the number of persons corresponding to its carrying capacity ( 75 kg per person ), lifted and left hanging for at least 5 minutes then lowered to water or floor. The liferaft shall be lowered safely, being free from any damage hazardous for its survival. The liferaft used for this test shall not be used as a life-saving appliance.

**9.1.18 Jumping Test** — Upon inflation, the liferaft shall be set afloat on water, and a sand bag of 75 kg shall be dropped from a height of 4.5 metres above sea level on to the canopy of the liferaft. The liferaft shall be free of any damage.

**9.1.19 Towing Test** — It shall be demonstrated that the fully loaded liferaft is capable of being satisfactorily towed at a speed of 3 knots in calm weather and that the towing arrangements and painter provide a factor of safety of 3.

**9.1.20 Canopy Closure Test** — To ensure the effectiveness of the canopy closures in preventing water entering the raft the efficiency of the closed enterances shall be demonstrated by means of a hose test or by any other equally effective method.

The requirement for the hose test is that about 2 270 dm<sup>3</sup> of water per minute be directed for 3 minutes at and around the entrances through 63.5 mm hose from a point 3.7 m away and 1.5 m above the level of the buoyancy tubes. A significant amount of water shall not enter the raft.

**9.1.21. Manoeuvrability Test** — It shall be demonstrated that the paddles provided are capable of propelling the raft when fully loaded in calm conditions at a speed of at least 0.5 knots over a distance of at least 23 m.

**9.1.22 Inherent Buoyancy Test** — To cater for hydrostatically released life-rafts it shall be demonstrated that the container or valise operationally packed with the raft has sufficient inherent buoyancy for setting the inflation system in action by means of the actuating line in the even of the ship sinking.

**9.1.23 Mooring Out Tests** — The inflatable liferafts shall be loaded with mass equal to the total number of persons for which it is to be approved and its equipment and moored in a location at sea or in a sea-water harbour. The liferaft shall remain afloat in that location for 30 days. However, the pressure may be topped-up once a day using the manual pump.

The liferaft shall not sustain any damage that would impair its performance. Further the inflatable liferafts shall be tested to a pressure equal to 3 times the working pressure and there shall be no seam slippage, cracking or other defects in the liferaft.

**9.2 Production Tests** — For manufacture of inflatable liferafts of the type having passed the type approval tests, the manufacturers shall perform on every liferaft mass checking as at 9.1.2, air tightness test at 9.1.4, relief valve function test at 9.1.5. The inflation test at 9.1.6.1 shall be carried out on a proportion of the production decided by statutory authorities. Every new devit-launched liferaft shall be tested by loading with a mass equivalent to 1.1 times the total mass of the liferaft, the equipment and the number of persons corresponding to its carrying capacity calculated at 75 kg per person. The loaded raft shall be lifted from the floor and left hanging for 5 minutes, after removal of the load there shall be no signs of undue distortion or strain.

## 10. MARKING

**10.1** Markings shall be in the language or languages stipulated by the statutory authorities. The inflatable liferaft and its container or valise shall have the markings of at least the items given in Table 4 provided at a readily visible location in a clear and indelible manner without harmful effects to the adjacent materials.

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**TABLE 4 MARKINGS FOR LIFERAFT AND ITS CONTAINER**

MARKINGS FOR LIFERAFT	MARKINGS FOR CONTAINER OR VALISE
1. Carrying capacity, that is, No. of men	1. Carrying capacity, that is, No. of persons
2. Maker's name or trade-mark	2. Marker's name or trade-mark
3. Serial No. of manufacture	3. Approving authority
4. Date of manufacture	4. To be serviced not later than.....
5. Approving authority	5. Emergency pack type
6. Symbols or signs to indicate positions of equipment and emergency actions	6. Painter length
7. Date of last servicing	NOTE — Also to be indicated on the painter
8. Temperature to which it has been tested	7. Maximum dropping height..... metres
	8. Serial number
	9. SOLAS ( DATE )
	10. TOP
	11. Instruction to launch
	12. Temperature to which it has been tested

NOTE — Qualification may be shown on log card stowed within liferaft.

# INTERNATIONAL SYSTEM OF UNITS ( SI UNITS )

## Base Units

QUANTITY	UNIT	SYMBOL
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

## Supplementary Units

QUANTITY	UNIT	SYMBOL
Plane angle	radian	rad
Solid angle	steradian	sr

## Derived Units

QUANTITY	UNIT	SYMBOL	DEFINITION
Force	newton	N	1 N = 1 kg.m/s <sup>2</sup>
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m <sup>2</sup>
Frequency	hertz	Hz	1 Hz = 1 c/s (s <sup>-1</sup> )
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m <sup>2</sup>